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OFFICIAL JOURNAL OF
THE MUSHROOM GROWERS'
ASSOCIATION

MGA BULLETIN

MAY, 1953 · NUMBER 41

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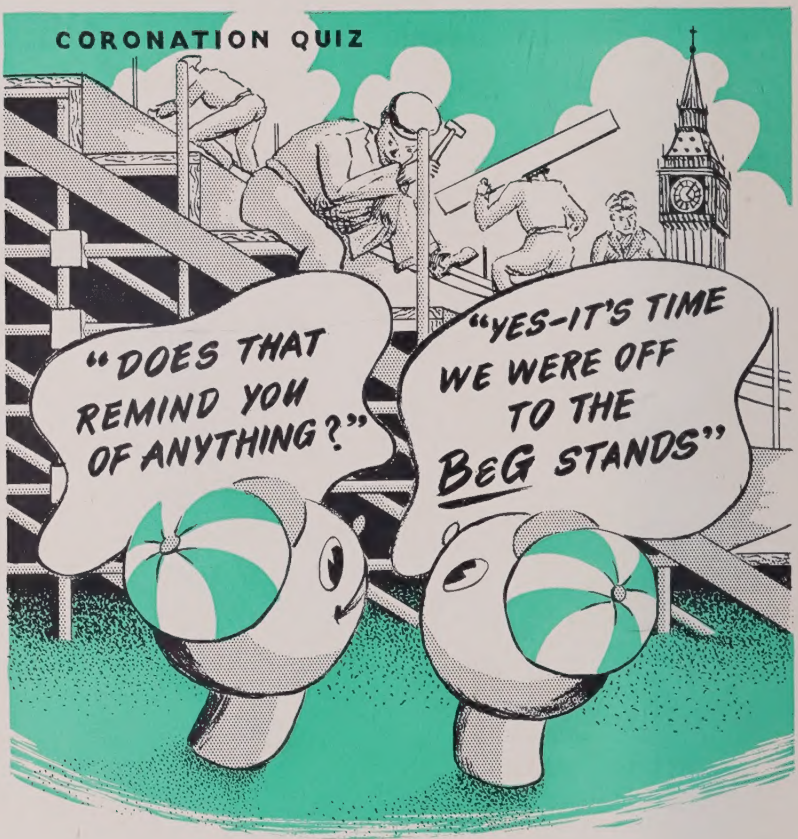
5 MAY 1953



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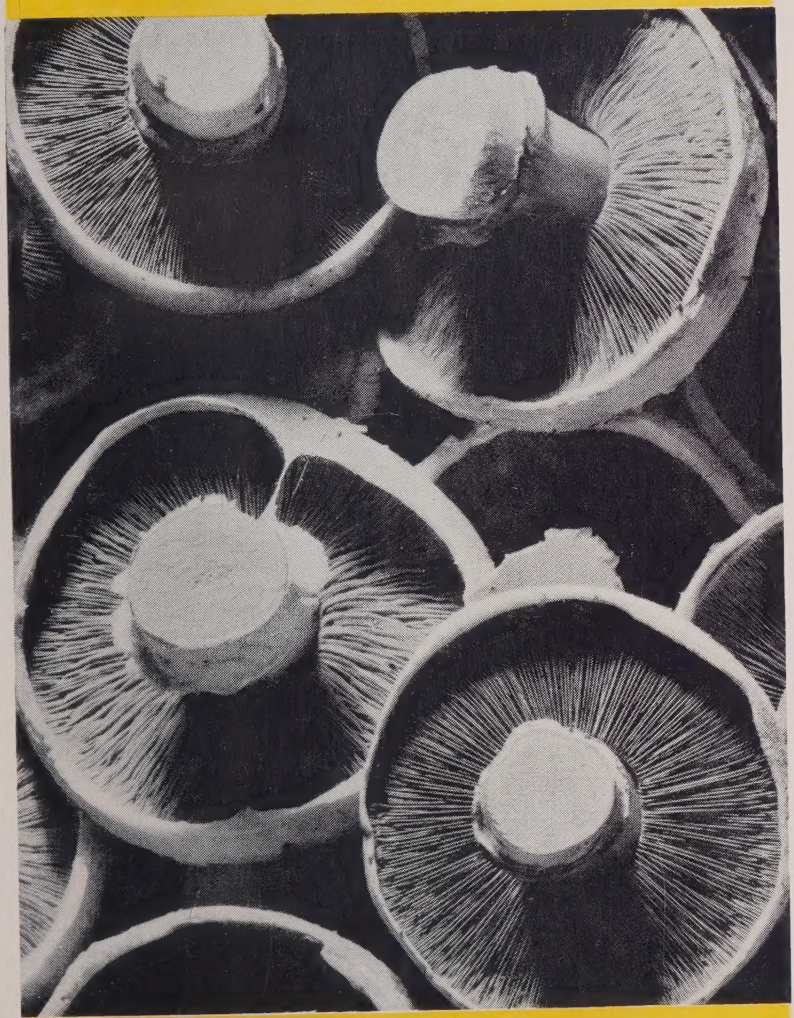

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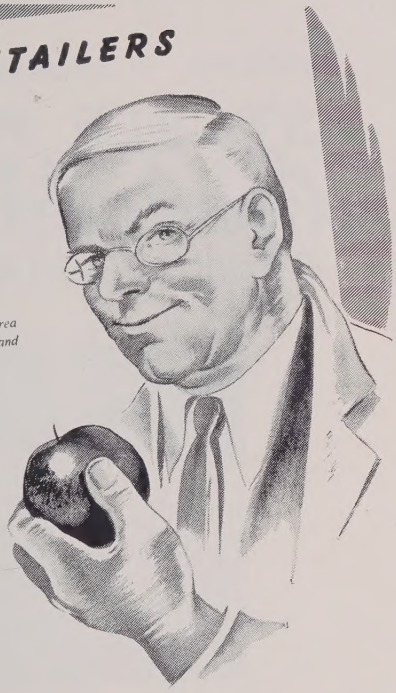

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the owner of a large shop in the industrial area which lies between Birmingham, Walsall and Wolverhampton.

"This 'ere shop o' mine's not in Baernigum yer know," says Enoch. "It's in the Black Country wheere yo cor sell nobody nuthin' unless it's paerfect. Befower they bought a pineopple they'd wanten to know what it 'ad bin pinin' obout, ar, an they'd ax yer if the sprouts ad bin growed in Brussels. Oh ar, they'm caerful shoppers.

"Them waerks conteens, yo con tek it from me thot the blokes as use 'em am particular tue. They like to try a somple faerst. Ar, an' then if they don't like it ofter they've aten it they don't 'ave it.

"Still I never get distaerbed cos I paerchase all me stuff from a faerst closs faerm. Ar, Nicholls, an' yo cor bate 'em."

*The name, of course, does not refer to any specific person.

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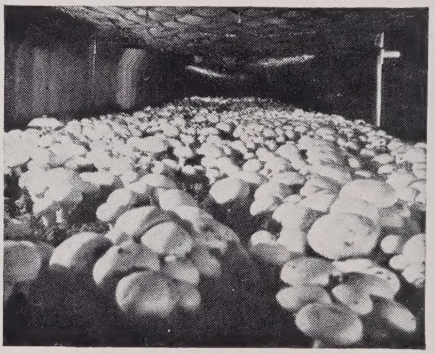

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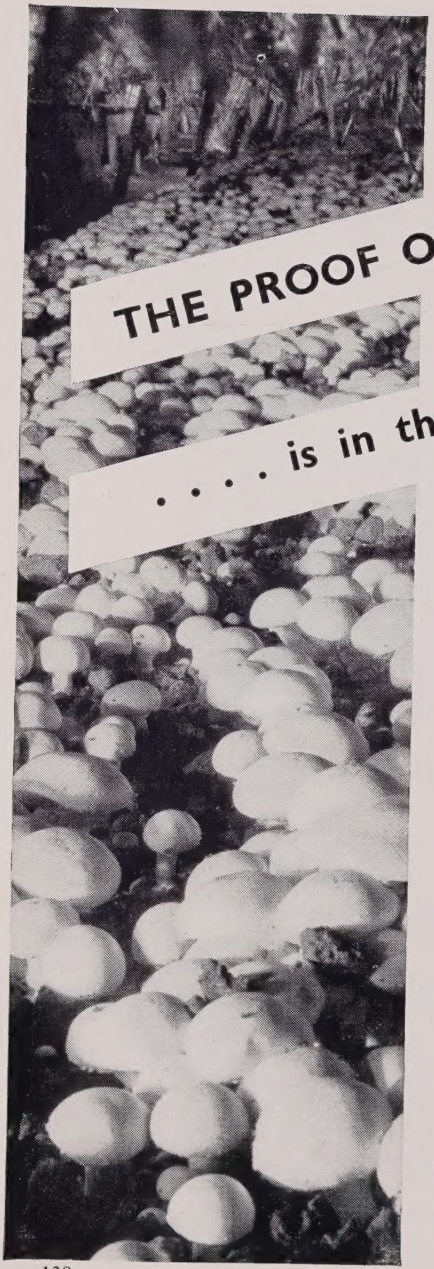

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. . . . is in the cropping!

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The
MGA BULLETIN
MAY · 1953
NUMBER 41

EDITORIAL

We Lose our Secretary

Every member of the Mushroom Growers' Association, at home and abroad, will learn with personal regret of the resignation of our genial Secretary as from 1st June.

" It was a shock to me to receive a personal call from Yaxley a few days ago and to learn that Angus Watson wished to resign ", Mr. Harold Boxall, MGA Chairman, told the Editor at the recent Open Day. " He has been with us for six years, coming to us in the early days, and the Association has grown up under his care. All members, I know, will join with me in wishing him every success in business, and we wish him luck—he'll need it, for he is to grow mushrooms commercially!"

Mr. Watson leaves the MGA at a time when membership is higher than it has ever been, the figures to-day being 325 growers and 191 honoraries, and a great deal of our success has been due to his warm personality and to the immense interest he has always taken in the Mushroom Industry. His presence will be much missed, most of all by the Editor of this Bulletin, who has enjoyed his friendship for close on 20 years. Good Cropping, Angus!

As we go to press, we are pleased to be able to announce that Mr. P. F. Anderson, of Sanderstead, Surrey, has been appointed our next Secretary as from 1st June.

★

NEW MGA MEMBERS

Flowerhill Nurseries Ltd, Istead Rise, Gravesend, Kent.
Godsmark, E. B. & Son, Grinstead Nursery, Grinstead Lane, Lancing, Sussex.
Iliff, D. D., Higher Pardlestone, Holford, Bridgwater, Somerset.
Kark, Dr. Charles, 58 Lister Buildings, Jeppe Street, Johannesburg, South Africa.
Langford Nursery, Clymping, Littlehampton, Sussex.
Skidmore, D. A., Moss Close Farm, Buchanan Road, Walsall, Staffs.
Sumares, J A., Rua do Pina 25, Funchal, Madeira.
Wiberg, A., Ovra Fogelbergsgatan 3, Gothenburg, Sweden.
Youd, A. H., 8 Guffitts Rake, Meols, Hoylake, Cheshire.

CHANGES OF ADDRESS AND/OR TITLE

British & International Addressing Ltd., BIA House, Chalton Street, N.W.1.
Gray, L. C. N., Wessex Nurseries, Lechlade, Glos.
Lee, C. C., Pilton Manor, Oundle, Northants.
Martin, A. W., Betteshanger Nurseries, Eastry, Kent.
(*Italics indicate Honorary Membership*)

WAGES GOING UP AGAIN?

The Union of Agricultural Workers has formally applied for **a substantial increase in basic wages.**

Are any workers on mushroom farms receiving no more than the basic minimum? On many farms, workers are receiving substantially more, **and** demanding overtime work, **and** getting it, **and** moaning at the price of food. A curious feature in these almost annual increases in wages is that no-one noticeably works any harder as a result.

TRIALS WITH PEAT

A number of members have been trying peat in their casing soil, or with other materials as casing, since we published Dr. B. B. Stoller's three articles last year. The Editor would be pleased to publish reports from these growers on their successes or failures.

Captain G. P. LAWRENCE *pleads for*

WINTER AND SUMMER SPAWNS

When we run into a spell of cold weather I am always appalled at the amount of coal that goes into my boilers to keep the houses at anything like the right temperature.

Even so, in very cold weather I cannot maintain the temperature I want till morning.

I could, of course, spend money on heating apparatus or insulation —but if I have learned anything in the last thirty years it is to resist, by every possible means, further expenditure on plant and apparatus, unless it is absolutely necessary.

I do not therefore want to spend money on heating and insulation.

It has occurred to me that our spawn makers might be able to help us to some extent.

Perhaps they are already doing so, I should not be surprised. But I would ask them: **What are the chances of developing a strain of spawn which would crop at 50 to 55° F.?** I believe mushrooms are grown at this low temperature in the French caves.

We should want such a strain of spawn to produce a crop of white mushrooms equal in weight of crop to that which we are now using, and in the same time.

Conversely, we would welcome a strain which could be used for summer temperatures.

I am well aware that it requires something rather more than a wave of the wand to produce such spawns, but if you want something you have to ask for it, and I hope our spawn makers will not mind if I make the suggestion.

A VISIT TO THE STATES

Described by E. H. JONES

Two years ago I was granted a Nuffield Foundation Travelling Scholarship to enable me to spend three months in the United States studying American methods of mushroom production. These notes are of some of the things that I saw there during my stay but it should be remembered that they refer to costs, methods, prices and production of two years ago and these are not necessarily the same to-day.

My programme was planned by the Agricultural Attaché at the British Embassy in conjunction with the United States Department of Agriculture. I simply stated what I wanted to see and they made all the arrangements. Once in America, Dr. J. W. Sinden of Pennsylvania State College was kind enough to help them plan my tour and worked hard to ensure that my path was smoothed from farm to farm. I am deeply conscious of the fact that, without his influence and practical help, I would have been unable to see more than a very small fraction of what I did see, and for that I am forever grateful.

During my stay I was able to visit all the main growing centres in the Eastern part of the country, from Chicago in the West to Boston in the North and Delaware in the South. In these notes there is room only for general observations.

One of the highlights of the tour was a visit to the plant of Yoder Bros., at West Winfield, Pa. This plant, the largest in Pennsylvania, is a completely mechanised Two-Zone tray system, incorporating a disused limestone mine as the growing zone. It consisted of an open composting site of concrete, about 300 yards by 100 yards, a set of heat rooms, a laboratory and spawn growing block, offices and 15 miles of excavated tunnels. These tunnels are so vast that there is an underground car park, packing rooms, garages, toilets and offices. Traffic in the main roadway is controlled by traffic lights. Composting was done by mechanical turners with a five man crew. These turners, designed and built to Yoder Bros. specifications, were self propelled on tracks and used in conjunction with a grab, could turn 350 tons per day. Water is added by a battery of sprinklers, and the heap is formed and the sides firmed by steel shutters towed behind the machine. Long racing-stable manure and Dr. Sinden's synthetic formula were used in equal quantities. Quick composting is the rule, from making the heap to filling taking 10 days. The synthetic formula in use included chicken manure, corn cobs, gypsum, and hay grown specially on their farm.

The trays are large, built of 2″ timber and measuring 8′ × 4′ × 6″, and, of course, have to be handled mechanically. One ton of compost filled 200 sq. feet of tray. They were cropped for 60 days and although no trashing was done, there appeared to be little or no disease. Parzate was blown through the mine weekly and controlled *Mycogone* and *Verticillium*. All the spawn used is grain, made on the premises from a strain developed for their low temperature and high humidity conditions.

About 1,600 quarts of spawn per week were being produced by a small staff of three or four girls with the simplest of equipment. The plant was most efficiently run by Mr. John Yoder and produced 4,000,000 lb. of mushrooms per year, with a total staff of 175. Average production that year was 1·6 lb. per square foot.

In contrast with this 'adaption' plant, was the farm of Chef-Boy-Ar-Dee Quality Foods Inc., which I visited with Dr. Sinden. This farm, built in 1946, was designed solely for the Two-Zone Tray System and embodies the most modern methods of heating and air conditioning.

Chef-Boy-Ar-Dee are food manufacturers, specialising in canned spaghetti, and the mushrooms produced are used in the nearby factory for the manufacture of a sauce for one of their packs of this food. An extremely tight cropping schedule is necessary to co-ordinate production with the actual requirements of the factory. All labour was Union controlled and a 40-hr. week worked. With full mechanisation, 26 men produced 780,000 lb. per year, which is, of course, astonishing. And they were hoping to reach 1,000,000 lb. The houses were designed to take 140,000 square feet of tray and were filled five times a year.

Grain spawn was used, with long racing stable manure boosted with brewers grains, composted on the Short Method and filled in 12 days.

The trays were smaller than those at West Winfield, being 4′ by $2\frac{1}{2}$′ holding 4″ of compost. A cropping period of forty days was used with no trashing or filling-in during this time, other than the removal of obviously diseased mushrooms.

Kennet Square, Pennsylvania, must be familiar to the majority of British growers as the centre of the industry in America. The area, of which the small town is the hub, embraces parts of Pennsylvania, New Jersey and Delaware and produces 60% of the total American production. Incidentally, it advertises itself as the Home of Mushrooms and Roses. The Mushroom part is obvious, all the eating places advertise "Steak'n Mushrooms," all the trains seem to be manure trains, and everywhere are colossal heaps of spent compost.

Here is the headquarters of the MGA of America. This organisation, to which I am indebted for many contacts with growers in the district, produces spawn (grain only), sells requisites, does pH and eelworm tests, gives advice and runs a cannery for its members. Dr. C. Aubrey Thomas of State College and Mr. George Mitchell, whose joint work on Eelworms is well known in Britain, are based at the MGA and I travelled many miles in their company on visits to growers.

Farms in the district ranged from small units of one "double" to huge combines with attached canneries, most being those with family labour only. Houses were of timber with shelf beds of about 60,000 square feet capacity, generally filled in September with a refill in March. During the summer only those with air conditioning were able to produce. Whilst I was in the district, the weather became very hot and humid and the price fell as low as 3/6d. per chip of 3 lb., with the bulk going to the canneries. Some growers were using the Sinden synthetic formula of hay, corn cobs, etc., and all seemed impressed.

With these cheap materials, cost of material could be covered in the first flush. Filling and emptying were done by gangs of coloured labour at a contract price, these gangs travelling from farm to farm.

To conclude these notes, I feel that I must mention the Knaust Brothers, who were the originators of the Tray System and who are practising interesting experiments in composting. Their plant at Coxsackie, N.Y., is probably the largest in the world, employing a labour force of 800, of which 345 are employed wholly on mushroom production and produce 13,000,000 lb. of mushrooms a year. Two canneries are run by this firm.

For such a huge undertaking, large quantities of spawn are needed and their plant produces 1,600 quarts of grain spawn a day.

NEWS *from* ABROAD

Keystone Mushroom Co., Coatesville, Pa., will begin a new consumer **advertising campaign** in May, according to William Jenkins Advertising, Philadelphia. Insertions will appear every month through April, 1951, in Ladies' Home Journal, McCall's, Women's Home Companion, Good Housekeeping, Better Homes and Gardens, American Home and Sunset. The campaign will stress the quality of the Keystone pack. Keystone is the oldest mushroom packer in America. It was established in 1920 by L. F. Lambert, who is recognised as the dean of mushroom growers. Keystone controls all mushroom operations from the production of spawn (seed) to the final packing. *New York Journal of Commerce*, 16.4.51.

Mushroom-growing has developed into an **£800-a-week industry** in less than 18 months. *Farmers' Weekly*, Bloemfontein, S.A. 14.3.51.

In an abandoned limestone mine in Pennsylvania, each **tray** is 30 square feet and yields over 45 lbs. of mushrooms.
Mining Magazine, (London), November, 1951.

Experiments were conducted (in Hungary) to determine why horse-manure beds for mushroom cultivation became exhausted in 2—4 months . . . . . None of the plant nutrients was reduced to an extent which could explain **exhaustion of beds.** Addition of fertilizers or fresh manure did not improve exhausted beds.
Chemical Abstracts, (Easton, Pa., U.S.A.) 10.10.51.

Marketing facilities (for **Belgian** mushrooms) are hampered by the growers' lack of co-operation, with the result that wholesalers often import from France. *Nurseryman & Seedsman*, 6.12.51.

In a deep **cellar** below a Copenhagen house is a 17th-century death cell, with hooks in the ceiling from which criminals used to be hanged. Now the cellar is to let. The owner of the house thinks that it would be ideal for mushroom growing. *Reveille*, April, 52.

(. . . . . and then he can always hang himself if he finds growing difficult ! M.C.L.)

Dr. R. L. EDWARDS introduces the Second

INTERNATIONAL CONFERENCE

AT GEMBLOUX, IN JUNE

A provisional programme of the Second International Conference, which is organised in two parts, has now been drafted and the subjects of many of the papers are available. The following account may be useful to readers who are considering whether the Conference will be interesting enough for them to attend.

FIRST PART

Tuesday, 16th June. *Morning.* Reception; opening session, tour of the Agricultural Institute (where the Conference meetings will be held.)
Afternoon. Papers on mushroom systematics, classification, etc. by Heinemann, Imler, and others.

Wednesday, 17th June. *All day.* Papers on physiology and biochemistry of the mushroom, growth substances, phosphorus metabolism, organic acids, by Willam, Renard, Laudet, Casimir, and others.

Thursday, 18th June. *Morning.* Papers on various aspects of mushroom growing by Rasmussen, Solari (tray system), Atkins (current problems), Edwards (cultural practices and their effects), Muijzenberg, Spoelstra (air conditioning), and others. *Afternoon.* Excursion to the Meuse valley.

Friday, 19th June. *All day.* Papers on compost by Rempe (use of sawdust), Delmas, Hauser, Sinden, Yoder, Stoller, and on casing soil by Flegg, Edwards, Kleermaeker, and others.

Saturday, 20th June. *Morning.* Papers on pests and diseases by Kux, Rempe, Cairns (eelworms), Sinden, Hauser, (mildew diseases) Gandy, Duncan, Edwards (truffle) and others. Visit to the Belgian Mushroom Research Centre.
Afternoon. Closing session and banquet. End of first part of the Conference.

SECOND PART

Sunday, 21st June. Is left free.

Monday, 22nd June. Visits to mushroom growers in caves and adapted buildings in Limbourg, leave for Holland and stay night at Nijmegen.

Tuesday, 23rd June. Visit to produce auction at Nijmegen, air-conditioned mushroom house, horticultural research station and Dutch mushroom research unit at Wageningen. Leave for Brussels.

Wednesday, 24th June. *Morning* free.
Afternoon. Visit to the Belgian Chemical Union (chemical products and their uses).
End of second part and of the Conference.

Of the papers so far submitted, 16 will be given in English and nine in French. Seven or more additional papers are expected, but titles are not yet available. Summaries in both languages of all papers to be read will be supplied to all members of the Conference at the opening Reception on 16th June.

The registration fee for membership of the Conference is 100 francs, and the charge for the Banquet on Saturday, 20th June, is 225 francs (including wines).

The Committee will arrange accommodation in Brussels at a good hotel, from dinner on Monday evening, 15th June, with bed, breakfast, and dinner each day, travel by car to and from Gembloux daily, to breakfast on Saturday, 20th June, inclusive, for the following charges per head, excluding drinks, but including gratuities and tax—(138 Belgian francs to £1; 100 francs=14/3):

Single room	2,345 francs (Belgian)
Single room, with bath	2,570 francs
Double room, with bath.. ..	2,545 francs.

These figures include the banquet charge.

Similar accommodation will be booked from dinner on Saturday, 20th June, with bed, breakfast, lunch, dinner, daily, journeys by car on the excursions, to breakfast on Thursday, 25th June, inclusive (including gratuities and tax, but excluding drinks) for 2,130 francs. Arrangements can be made for these comprehensive charges to be paid in this country through Travel Aids, 64B Buckingham Gate, London, S.W. 1.

There is also limited accommodation available in private lodgings in Gembloux during the first week for about 75 francs per night per head for bedroom only. Meals are available at hotels in Gembloux, breakfast 15-20 francs, lunch 45-75 fr., and dinner 25-75 fr.

Owing to the extent of the hotel and travelling arrangements to be made, these must be completed well in advance, and **the final date for acceptance of members is 15th May.**

So far about 60 people from 10 countries have announced their intention to take part in the Conference.

Copies of the programme and registration forms are available from the Secretary, Mlle. L. Engels, CEREC, Institut Agronomique de l'Etat, Gembloux, Belgium. Dr. R. L. Edwards (MRA, Yaxley) is a member of the scientific organising committee and will be pleased to help or advise anyone who is considering attending the Conference.

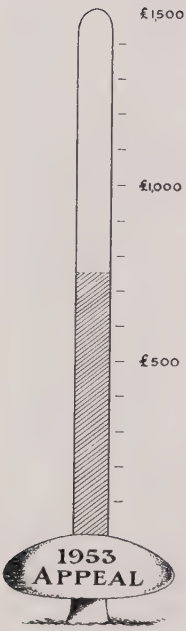
2nd JUNE A HOLIDAY

Coronation Day will be a paid holiday for agricultural workers with additional pay at ordinary time rates for those required for essential duties, announces the Agricultural Wages Board.

SEEN THIS?

The Four Oaks "Kent" pattern pneumatic knapsack sprayer mounted on a Four Oaks mobiliser truck, to which it can be attached instantly by the movement of one simple clip, gives easy, comfortable spraying, standing or walking. The price of the truck is £3.17.6; the apparatus complete costs £18.7.6. It is available from the manufacturers or through the principal sundriesmen.

Research Appeal



There has been an excellent response to the 1953 Appeal for funds to maintain Yaxley research on mushrooms launched in February. One of the first letters received by the Chairman was from the Directors of **Messrs. Francis Nicholls Ltd.**, the well-known market salesmen:

"*In response to your recent Appeal, we have pleasure in enclosing herewith our cheque for one hundred guineas being a donation towards the sum required to enable Mushroom Research to be continued during the current year. As Salesmen we have noted in recent years a steady improvement in the general standard of quality of the Mushrooms reaching the markets, but even so it is evident that there is still a vital need for further research, and we trust that you will have no difficulty in obtaining the financial support necessary to enable the Yaxley Station to continue to operate until the satisfactory completion of your negotiations with the Board of Management at Toddington.*"

Mr. Fred. C. Atkins at once replied: "I know my fellow Directors would be anxious to join with me in thanking you for yet another substantial donation of £105 0s. 0d. to the Research Association. We feel it is tremendously important to keep the Research Station going this year, and we are most grateful for your help."

Messrs. J. Beveridge & Co. Ltd., the Kinross growers, repeated their customary generous contribution of £50, and another £50 was sent by **Messrs. H. Mount & Sons Ltd.,** the spawn makers. **General Sir Oliver Leese,** growing in Shropshire, is giving £30. **Messrs. W. Darlington & Sons Ltd.,** the spawn makers and sundriesmen, contributed 25 Guineas ; **Messrs. Noble Mushrooms Ltd.,** the Yaxley growers, sent £25; and **Messrs. R. H. Filmer Ltd.,** the Sussex growers and London box-manufacturers, sent £21. These much appreciated donations and many more are listed below; they take our 1953 Appeal just past the £750 mark.

	£	s.	d.
Brought forward (see April Bulletin)	127	5	0
Nicholls, Francis & Co. Ltd.	105	0	0
Beveridge, J. & Co. Ltd.	50	0	0
Mount, H. & Sons Ltd.	50	0	0
Darlington, W. & Sons Ltd.	26	5	0
Noble Mushrooms Ltd.	25	0	0
Filmer, R. H. Ltd.	21	0	0
Douglas, Brig. A. S. G.	20	0	0
Collier, Sir Conrad	15	15	0
Broome & Green (London) Ltd.	10	10	0
Griffiths, G. C.	10	10	0
Hedon Growers Ltd.	10	10	0
Lea, J. S. B. (Dunley & Co.)	10	10	0
Linfield, A. G. Ltd.	10	10	0
Sparkes, A. G. (Smugglers' Farm) Ltd.	10	10	0
Stewart-Wood, J.	10	10	0
Thompson, Raymond	10	10	0
Beardsell, D.	10	0	0
Bleazard, C. & Sons Ltd.	10	0	0
Fammarps Tradgard (Sweden)	10	0	0
Lawrence, Capt. G. P.	10	0	0
Morgan, Wm. Ltd.	10	0	0
Poupart, T. J. Ltd.	10	0	0
Lucas, J. C. & Sons Ltd.	5	5	0
Meath Packers Ltd.	5	5	0
Murphy Chemical Co. Ltd.	5	5	0
Wood, J. & Sons (Leeds) Ltd.	5	5	0
Worthing & West Sussex Growers	5	5	0
Bardsley, F. & Son	5	0	0
Davey, T. W. Ltd.	5	0	0
Housing Estates Ltd.	5	0	0
Johnson Bros. & Co. (Derby) Ltd.	5	0	0
Oliver, A. P.	5	0	0
Sparling, T. A. G.	5	0	0
Thompson, J. R.	5	0	0
Ulm, J.	5	0	0
Simons, J. E. R. Ltd.	4	4	0
Fred, Corwin (U.S.A.)	3	10	0
Gibbons, J. S.	3	3	0
Jackson, R. L. O.	3	3	0
Zivkovic, S. A.	3	3	0
Homer, C. H.	3	0	0
Parsons, Mrs. R.	3	0	0
Nielsen, E. (Denmark)	2	10	0
Sandford, Captain A.	2	10	0
Albrecht, C. R.	2	2	0
Avalon Mushrooms Ltd.	2	2	0
Barton, H. J.	2	2	0
Batchelor, J. G.	2	2	0
Bentley, A. J.	2	2	0
Eclipse Peat Co. Ltd.	2	2	0
Faulkner, M. M.	2	2	0
Griffin, G. D.	2	2	0
Maney, W. S. & Son Ltd.	2	2	0
Piatkowski, S.	2	2	0
Tooley, C. W. & Son Ltd.	2	2	0
Vitax, Ltd.	2	2	0
Sancewicz, Z.	2	0	0
Smith, G. D.	2	0	0
Tweedie, Captain G.	2	0	0
Wild, R. F.	2	0	0
Wright, C. W.	2	0	0
Jupp, J. S.	1	10	0
Jackson, T.	1	5	0
Ady, J.	1	1	0
Clifford, W. & Sons Ltd.	1	1	0
Dalton, D. N.	1	1	0
Hagger, C.	1	1	0
Smith, G. W. & Son (Thorpe) Ltd.	1	1	0
Cave, A. E.	1	0	0
Hall, A.	1	0	0
Bankers' Orders (Jan.-Mar.)	30	0	0
	£753	17	0

CORRESPONDENCE:

Some of your members may be interested in a book I have for sale—" British Fungi ", by George Massee, with 40 coloured plates by Ivy Massee. The price is 30s. 0d. *H. TRESIDDER*, 151 *Clarence Road, Fleet, Hants.*

MUSHROOM GROWING TO-DAY

New Edition reviewed by M. C. Luxmoore

Mr. J. L. Kessler has already reviewed this publication in its original form, and having tended to ally himself with the unscientific grower, belied the fact by a knowledge of " cryptogamous plants " and suggesting that the book is clearly intended very largely for beginners. Be this as it may (and I have not asked the author his intention), I find such solace in the work that, if Mr. Kessler is right, I must surely be amongst the puerile in the gentle art of growing.

What indeed *is* scientific growing? If it is care, method, sanitation, and scrupulous attention to detail, a number may qualify. If it includes chemical formulae, and knowledge of scientific terms, a very small minority will aspire.

And here is Atkins's hand proffered in the extensively revised edition of his *Mushroom Growing To-day*. Nothing yet has so successfully breached the void between the scientific and the practical.

Atkins has the happy knack of serving up a palatable dish.

Though one may not agree with this or that, even the most exacting will be hard put to it to expose a fallacy. The many intricacies of growing seem only too ready to fall into place, under Atkins's able direction, and once pigeon-holed are easily accessible for future reference. Details have been checked with meticulous care.

Here is a revealing demonstration of a clear headed journalist, ironing out a plethora of fact and fiction, and producing it in easily assimilated form. And this above all is the genius of Fred. Atkins. He is at pains to meet us on our own ground, at our own level. In consequence we never once suffer scientific indigestion, nor are brought up sharply by incomprehensible terms.

What joy it is to read that " hydrogen-ion activity is meaningless to the average grower any way "; we proceed on our way re-assured. At the same time he does not laxly allow us to escape all scientific jargon, and we are kept nicely within bounds, which gratifies our self esteem.

The additions since 1951 are numerous, amongst them a complete new chapter on the Tray System. Short composting is explained at length, and the modern grower is ill-equipped without knowledge on these latest developments. It is hard to imagine that any grower could afford to be without this wealth of information.

Were I to be restricted to one book on the subject which provides my bread and butter, I should unhesitatingly choose Atkins's revised edition.

Nor is this surprising, for the author, and the Company for which he is technical director, have done more for Mushroom Growers in this country (free of all pecuniary benefit) than the rest of us are likely to achieve in a lifetime. One might add that, though Mushroom Growers are far from ungenerous, for some peculiar reason this fact has never been either generally recognised or applauded.

At Refresher Course, Peterborough, 16th April, 1953

EELWORMS AS PESTS OF MUSHROOMS

By **B. D. MORETON**
NAAS Advisory Entomologist at Wye

EELWORMS belong to the group of animals known as the Nematoda, and from this the Americans have derived the popular name " Nemas ". Many nematodes are important as intestinal parasites of animals as well as parasites of plants. They are threadlike with very slender, cylindrical bodies, colourless and transparent, without any segmentation. They are legless, travelling by means of serpentine movements of the body through films of moisture, hence the name of " eelworm ". Most of those concerning us as plant parasites are a millimetre or less in length and almost invisible without the aid of a microscope. When mature the females lay transparent eggs, often in great numbers, and breeding may be rapid and continuous under favourable circumstances. Moisture is essential for their welfare, but under dry conditions many are able to enter a resting phase which can survive for long periods, often years.

The number of different kinds occurring in this country as plant parasites is comparatively few, and examples are the potato root eelworm, root-knot eelworm, stem eelworm, potato tuber eelworm, and strawberry eelworm. For every parasite there are many nematodes living blameless lives wherever there is moist decaying organic matter—in fresh water, the soil, rotting plants, etc. These are saprophytic, *i.e.* living on the products of decay, or are predatory; and for convenience we will consider separately these two groups, the plant parasites and the saprophytes.

Saprophytic Eelworms

Paine in 1919 showed that a species of *Rhabdites* could spread the bacteria assumed to be responsible for brown blotch disease, and in 1933 Steiner suggested that the same *Rhabdites* acted as a disease agent in mushroom beds. Eelworms usually carry bacteria with them, some even can inoculate them into plants, and the association between eelworms and bacteria may be of some importance.

In 1950 Thomas and Mitchell in U.S.A. claimed that crop failures were often associated with heavy infestations of *Rhabdites* type eelworms in the beds. Compost, although sometimes reddish, and mycelium appeared normal but cropping ceased. Eelworms, they said, could also carry bacteria causing bacterial pit disease and spread it through the beds.

Such infestations have so far not been discovered in this country, and the extent to which this and allied species normally occur in mushroom beds is unknown. We check for eelworms as a routine measure and in most samples saprophytes are very few or virtually absent. Should they occur in large numbers it may be that this is a sign that the compost had not been properly treated and that its condition had changed from the optimum for mushroom growth. Over-watering might well encourage abnormal multiplication of eelworms.

Parasitic Eelworms

Attacks by parasitic species are relatively uncommon, but when they do occur they can be devastating and extremely difficult to control. They have come into prominence in recent years but whether there has been a real increase one cannot say. Their recognition at any rate is recent, although a little known record of Newstead's in 1906 describes a mushroom bed in Britain heavily infested with eelworms closely resembling the stem eelworm.

Thomas and others in 1950 showed that crop failures in Pennsylvania were associated with *Ditylenchus* species and that the mould *Arthrobotrys* growing over the casing soil on affected patches was a parasite of the eelworm. Since then a number of cases have been investigated in Britain and we have had three in Kent, Surrey and West Sussex.

The eelworm usually occurring as a pest is *Ditylenchus destructor*. This is the potato tuber eelworm, related to but distinct from the stem eelworm attacking onion, narcissus, oats, lucerne, etc. The potato tuber eelworm has only recently been recognised as a species and much has to be learnt about it. B. Goodey has shown that it can attack, besides potato tubers, bulbous Iris, Gladiolus, Tigridia, and the roots of lilac. It also occurs in hop roots, and in certain parts of the country is a serious potato pest causing a " dry blight ". It also lives in weeds such as wild mint, field sowthistle and hemp nettle.

Seinhorst in Holland reproduced attack on mycelium in the laboratory in 1951, and used *D. destructor* from potato; he also got eelworms from mushroom beds to attack potato. At Wye we have confirmed that *D. destructor* can cause the disappearance of the mycelium from compost, but have failed to transfer it from mushroom to potato or other crops. What its other hosts may be, and means of reaching a mushroom holding, is a matter of guesswork.

Affected beds cease to crop, often in patches of varying size; the compost is found to be devoid of mycelium, and it usually has a pungent smell with a suggestion of an odour of acetylene. The Americans call it a " medicine-like " odour.

André Sarazin in France has said that water leachings from infested soil, filtered free of eelworms and watered on to uninfested beds, results in a suppression of cropping as if eelworms were actually present. The possibility of toxins released by eelworms and affecting mushroom growth is an interesting question.

Cairns in U.S.A. in 1952 stated that species of *Aphelenchus* and *Aphelenchoides*—the latter group includes the chrysanthemum eelworm – attacked mycelium in mushroom beds, but such attacks have not been known to occur in Britain.

Control Measures

1. **Infested Beds:** The only treatment of infested beds or boxes is complete removal and destruction. Hydroxyquinoline sulphate has not been found at Yaxley to have any effect on *D. destructor*.

2. **Treatment of Infected Buildings:** A few eelworms persisting in crevices in woodwork may be sufficient to build up damaging infestations in the following crop. The Americans do not find that formaldehyde treatments are adequate, and after the usual thorough clean out they

recommend the introduction of steam. An exposure of 150° F. or more for several hours appears to be desirable. Before steaming all surfaces should be thoroughly wetted, preferably for 24-48 hours, to activate the eelworms.

The most difficult houses to deal with are those containing old timber supports, where the timber has become cracked and upper surfaces soft and spongy. It would pay to replace these with steel structures. The use of stacked boxes instead of orthodox beds obviates the difficulty of cleaning permanent structures.

The disinfestation of bed boards is another difficult problem. While *D. destructor* is readily killed by a few minutes immersion in 2% cresylic acid, it is not sufficient merely to dip the boards in this liquid. Air bubbles will protect parts of the wood and air locks will seal cracks, and in the case of boxes, spaces between joints. The procedure suggested as worthy of trial is to drop the boards into a hot bath of cresylic acid as near boiling point as possible for 15-20 minutes, then transfer them to a cold bath of cresylic acid so that liquid will be drawn into crevices during cooling. An alternative to cresylic acid, chlorophenol, which is now used at 0·25% in bulb baths, might prove useful, but is rather persistent and nothing is known of its effect on mushrooms.

3. **Prevention**

(*a*) Casing soil should be steam sterilized, exposing it to above 150° F. and preferably near 180° F. for at least 20 minutes. Formaldehyde is inadequate and may even encourage eelworms by killing their fungal parasites, according to Thomas & Mitchell. Little is known of the value of " DD " and other fumigants.

(*b*) The surface of composting sites should be rendered concrete so that thorough cleaning is possible, and it should be soaked with 2% cresylic acid.

(*c*) Peak heating offers the most likely means of preventing eelworms from reaching dangerous levels. The necessary heat exposures to destroy eelworms in mushroom beds are not accurately known, but American workers advocate 140° F. for at least a day, but the temperature should not be allowed to reach 150° F. Assisted heating would of course be necessary. In the tray system where such peak heats are more easily obtained, it is possible that special chemical treatment of boxes in between crops becomes unnecessary.

The stem eelworm in narcissus bulbs is destroyed by an exposure to 110° F. for three hours, this length of time being necessary for heat to penetrate the centre of the bulb. In strawberry runners it is killed by 115° F. for 7 minutes. The chrysanthemum eelworm is killed by 110° F. for 30 minutes, 115° F. for 4 minutes, and instantaneously at 126° F., and it appears that eggs are no less susceptible than the adult worms.

There is no reason to believe that the reactions of *D. destructor* would be markedly different. At Wye we subjected bottles of compost infested with *D. destructor* to different temperatures for various periods, and the lowest, 108° F. for 8 hours, resulted in their complete destruction. The introduction of fresh spawn was followed in due course by good growth of mycelium, whereas in the controls the mycelium began to run and then slowly disappeared. Eelworms remained numerous in the controls but none could be recovered from the treated bottles.

It is difficult to understand why infestations have developed in houses where peak heating has involved exposures that would seem in excess of that required, unless "cold spots" occur. Thomas has shown that there may be 10° difference between the centre of a wet lump of manure and the bed a few inches away. Joints between boards, and the lower surface of the bottom beds might well be at temperatures considerably lower than those registered by thermometers in the usual positions. We would like to know:

1. Where the "mushroom" *D. destructor* occurs in nature and how it may become introduced into mushroom beds.
2. The necessary heat exposure to kill it.
3. Whether all parts of the beds do in fact reach sufficiently high temperatures during peak heating.
4. The best way of disinfesting timber structures, bed boards and boxes.

CORRESPONDENCE

Mr. F. R. Frampton has given an excellent description of the **low pressure high velocity hot water heating system** in which steel pipes, preferably about 2″ diameter, instead of the usual 4″ C.I. pipes are used. The system should be designed to work with a difference between flow and return mains of about 10° F., and not more than 15° F. One disadvantage against the system was given as the lack of steam for sterilisation, but this objection does not always apply. In many cases provision has been made for sterilisation with low pressure steam, in particular where two boilers are needed, by having one of the type which is suitable for steaming at not more than 25 p.s.i. and so arranging the pipe-work and valves that this same boiler, after completely filling with water, can be used for the greater part of the year as a hot water heating boiler. When steam was required, the L.P. steam boiler would in effect be isolated from the hot water system and work as a separate steam unit. An electrically driven feed pump and automatic feed water control would form part of the steam boiler equipment, and if in addition the boiler was either a gravity feed type or fitted with an underfeed stoker, the plant would be entirely automatic. The cost of a suitable type of low pressure steam boiler, excluding feed pump and steam fittings, is not much greater than a corresponding size of hot water boiler.

W. H. GAMBLE.

PRESS CUTTINGS

Humidity is important, and should be maintained from 85-90 per cent. (said Mr. A. D. Harrison at Reading). A whirling hygrometer is said to be a more reliable guide to relative humidity than the normal wet or dry bulb thermometer. *Grower*, 15.12.51.

Casing Soil and its management is a very big factor in the production of high yields . . . . . It is important that air gets into the compost as well as allowing the noxious gases to escape from it. The greater preference within recent years for a more open casing soil is significant and will assist very much in this process.

Dr. I. F. STOREY in *Grower*, 8.12.51.

LARGE ATTENDANCE AT HARRIETSHAM

Close on 100 MGA members attended one of the most successful area meetings at Fairbourne Manor, Harrietsham, Kent, on 21st March, at the invitation of **Air Vice-Marshall Sir Conrad Collier.**

Sir Conrad and Lady Collier welcomed the visitors and their wives, and their son, **Mr. John Collier,** answered a number of questions concerning their method of growing.

After tea at the Roebuck Inn, **Mr. George Allen** (of the MGA Executive and the Committee of the organising group in Kent/Surrey/East Sussex) expressed the members' thanks for a most interesting farm walk and said how pleased he was that headquarters had sent along the MGA Secretary, **Mr. Angus Watson,** all the way from Yaxley.

Mr. Harold Boxall (MGA Chairman) opened a discussion on the Tray System with the words: " I do not grow in trays and have no intention of doing so ", and started a very lively ball rolling. It was noticeable that all present were willing to share their experiences and knowledge with their colleagues.

Mrs. Baker and **Mrs. Jones** were warmly applauded for their organisation of the function. Mr. Boxall was thanked for attending, and it was agreed that the next meeting would be in Worthing in conjunction with the Worthing and West Sussex Growers.

Invitations are to be sent to market salesmen specialising in mushrooms in the hope that a firm policy for marketing and publicity can be worked out.

Sir Conrad Collier welcomes his guests

With acknowledgment to THE GROWER *(18.4.53)*

YAXLEY'S OPEN DAY

SYNTHETIC CASING MATERIALS were the centre of interest at the annual Open Day of the Mushroom Research Association's Station at Yaxley on Wednesday. Visitors included growers from Great Britain, Eire and the Continent of Europe, several NAAS horticultural officers, and representatives of all the principal mushroom sundriesmen.

Dr. R. L. Edwards, the Director of Research, and **Mr. P. B. Flegg** showed samples of materials they have been using in laboratory experiments on casing soil, both the raw materials and some mixtures illustrating their moisture-holding properties and air space.

Four kinds of peat, Vermiculite in various size grades, and mixtures of these two different materials, together with sand and the local clay-loam subsoil were displayed.

In the test houses were seen shelves, trays and pots cased with some of these mixtures. Experiments were in progress with three very different types of soil used alone and mixed with peat. Some trial plots were cased with different thicknesses and some were receiving different rates of watering, from heavy and frequent to light and occasional sprayings.

"*We have two promising artificial casings*", said Dr. Edwards, "*but we don't know yet how best to use them. They are so different from soil in some of their properties, particularly as regards watering, and we must learn more about their management before precise treatments can be recommended.*"

The two casings referred to were peat and vermiculite, equal parts by volume, and peat and sand, equal parts by volume; both should be suitably limed to neutralize acidity in the peat.

The peat used hitherto in the experiments was imported Sphagnum peat. But others would be tried. The research workers did not know whether other peats would be as satisfactory, nor had relative costs been compared.

" We believe the vermiculite should not be finer than the medium grade ", added Mr. Flegg. " Probably the coarsest grade will be the best, i.e. between $\frac{1}{4}''$ and $\frac{1}{2}''$, but it may be all right between $\frac{1}{8}''$ and $\frac{1}{4}''$."

Miss D. G. Gandy's experiments in the Disease Chamber were designed to compare the sterilizing efficiences of Sterlzal, formalin and heat. There were pots in which she was endeavouring to discover what effect, if any, creosote and Sterlzal had on growing mushrooms.

In the laboratory, Miss Gandy had samples of various diseases and an interesting chart showing the incidence of various common pests and diseases based on specimen submitted to Yaxley for advice over the past three years.

Asked if anything unusual had become apparent from her records, she said: "*The chief deduction is that Eelworm is very much on the increase—or growers are becoming more conscious of it. Unfortunately no-one yet knows what to do about it.*"

REFRESHER COURSE AT PETERBOROUGH

Five lectures of interest to Mushroom growers were given at a Refresher Course at Peterborough's Town Hall on Thursday, arranged by the Yaxley Research Station. Mr. Fred. C. Atkins, MRA Chairman, was in the Chair.

Mr. B. D. Moreton, the NAAS advisory entomologist at Wye, summarised the present inadequate knowledge of Eelworms as a Pest of Mushrooms. His paper is given in full on pps. 149-152 of this issue.

Miss D. G. Gandy, MRA microbiologist, discussed the Use of Copper Sulphate as a Selective Fungicide in Compost, with particular reference to the control of *Pseudobalsamia microspora.*

Mr. Stanley Middlebrook, the well-known Yorkshire grower, gave facts and figures from his own experience which had persuaded him that the Tray System was not what so many growers thought it to be, viz. an easy way to grow more mushrooms more cheaply.

Mr. P. B. Flegg, MRA chemist, joined **Miss Gandy** and they explained the value and the limitations of Laboratory Examination of Composts, Casing Soils and Mushrooms, and the Course concluded with a paper by **Dr. R. L. Edwards,** MRA Director of Research, and **Mr. Flegg** on Some Artificial Mixtures used in Casing Soil Experiments.

MUSHROOMS FROM EIRE

The Worthing and West Sussex Growers are concerned over the increased importation of mushrooms from Eire. For political reasons the growers in Eire are exempt from tariffs on imports to Great Britain. The Glasshouse Produce Committee of the NFU is making inquiries. Here are some cuttings from Irish newspapers:

The modest mushroom has become big business in this country, and growers are developing what may become a very important export trade. From Cork to Dublin growers are producing more and more mushrooms . . . . . Daily consignments are being flown to Britain. The growth of the industry may be gauged from the fact that in 1950 the export value was only £55,000, and this year it has risen to £100,000.

Irish Independent, 19.9.52

There are now seven or eight firms engaged in this trade. One Co. Meath firm exports to Britain the entire yield of its 20,000 sq. ft. of hothouse mushroom beds . . . . Several tons of Irish mushrooms are flown every week to British markets. This export trade has been built up in the face of competition from long-established commercial growers in the South of England who, however, have been somewhat handicapped by a shortage of suitable manure . . . . . At the moment the export demand is still greatly in excess of the supply. *The Irish Press* (*Dublin*), 19.9.52

The growth of the export side of the industry has been made possible by the provision of air-freight services. In the past, the export of mushrooms would not have been a commercial success because of their perishable nature. Air-freight services, however, have enabled the mushrooms to be conveyed to markets in Liverpool and Manchester within a few hours of picking in Co. Dublin or Co. Meath . . . . Inquiries have been received from Bristol and Birmingham. Irish growers are confident that within a short time they will be able to double their production to meet a growing export demand. *Irish Times* (*Dublin*) 20.12.52

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HORMONES AND VITAMINS

The Eastern Daily Press published this note in November, 1951: There are different **hormones** in the waste products of male and female animals, and it is quite possible that one more than another may promote the growth of mushrooms . . . . . No thorough investigations of the problem seems to have been undertaken and at the present time nothing is known of the effects of sex hormones on the growth of any of the larger fungi.

Dr. Cecil Treschow, writing in 1944, said the growth of mushrooms resulted in a considerable reduction in the amount of growth substances in the compost, which indicated a potential risk at any rate that some might be exhausted before the end of the crop.

When **Eldrow Reeve** was here in February he gave me a copy of his paper on *Vitamin Supplements* which concluded that calcium pantothenate, aneurin hydrochloride, pyridoxine hydrochloride, niacin, and riboflavin, added singly or in combination to mushroom composts, did not affect the growth or yield.

McGregor Bulloch carried out limited research for Noble Mushrooms Ltd. in 1946 which suggested that aneurin might be a useful supplement to synthetic composts. This finding was not supported by subsequent tests.

The **Yaxley Research Station** between 1946 and 1948 found that calcium pantothenate, particularly, and riboflavin, phenoxyacetic acid, and stilboestrol, to a less degree, increased the yield from synthetic compost. Calcium pantothenate also advanced the start of cropping.

Now *The Grower* (14.3.53) reports that the Ohio Experiment Station **increased the yield by over 50 per cent.** from horse-manure compost by spraying a solution of four B vitamins on the beds before casing, and repeating the treatment five times at ten-day intervals. The formula (in milligrams) is: aneurin hydrochloride, 0·5; riboflavin, 1·0; nicotinic acid, 12·5; and pantothenic acid, 3·75. These amounts should be applied to a square foot of bed area at each of the six applications.

A note of caution. **Dr. A. M. Kligman** suggests on p. 53 of the J. B. Swayne " Handbook of Mushroom Culture " that " one must view with scepticism at present reports of increased yield following the addition of vitamins." Hoffman's work implied that horse manure was deficient in certain vitamins, but many bacteria were capable of synthesizing vitamins, and compost possessed rich bacterial flora. " Moreover ", Kligman adds, " under controlled cultural conditions Dr. Robbins has not been able to show that the mushroom requires any of the known vitamins for growth."

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Stanley Middlebrook's Diary

Mar. 14. According to the *London Evening Standard*, Mrs. Emily Hannah Covil of Dartford, who to-day celebrates her 100th birthday " will start the day with a meal of fried bacon, mushrooms and toast, with plenty of tea. Her explanation of her long life: ' I have always eaten a good breakfast with plenty of mushrooms.' "

Mar. 16. What *does* one do with trashings, cores, stumps, choggings or what have you? Should they be spread on spare land, buried in deep pits, burned, or fed to the pigs (thus automatically flavouring the bacon)? Some may have no spare land or pits. I understand trashings don't burn readily. And perhaps we don't all have a pig. Where *do* they all go? I can't answer that, but I can ease the problem of moving them some distance. I have found a most useful all-metal barrow suitable for trashings. It is known as the " Somerset ", a two-wheel effort (16″ pneumatic), very easy to wheel even when full to the brim, and simple to tip. It holds a good load, being deep-bodied with a large hopper-like top. Cost, something over £12. Recommended.

Mar. 18. How many holes can you pick in this new (?) method of growing? A certain grower makes a narrow " mushroom house " of straw bales and roofs it over with straw supported by any old timbers. He puts in his compost and (to quote) " spawns the compost, floors, walls and all ". He carries on cropping until he " gets nothing but disease ". Then he sets fire to the lot! What could be cheaper? Insurance companies can't quibble in this case at a decisive method of getting rid of site contamination!

Mar. 22. My references to various spawns and their behaviour have apparently started the impression that I am a spawn maker testing out my own products. Heaven forbid! The last thing I would want to do is to blame myself when things go wrong.

Mar. 24. I had, of course, a preview of Knud Reffstrup's letter about Salt v. Dactylium, and acted on its advice at once. Since then we have had a marked reduction of the trouble and feel reasonably confident in attributing the easement to salt. But it could be the fresher air of Spring and the mushroom's greater resistance to competitors which is frequently noticed at this season. For instance a grower reports a sudden cessation of Bacterial Pit coinciding with our reduction of Dactylium. He can offer no explanation.

Mar. 26. From time to time I have been privileged to report phenomenal cropping. A visitor to-day caps all previous records and presents a new target. He has just done 1.1 lb. per sq. ft. in 3—repeat THREE—days. I would fain disbelieve him but unfortunately he has several witnesses — persons too eminent in the Industry to encourage or propagate falsehoods.

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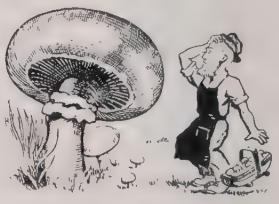
Cheshunt Compound
Bordeaux Mixture
Lime Sulphur
Organo Mercury Dusts
Mercury Chloride
Copper Lime Dust
Formaldehyde



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The only consolation is he doesn't know how he's done it, and I hope he won't do it again. This sort of jet propulsion is altogether too unnerving!

Mar. 30. A letter to-day contains a statement that aeration of casing soil is less important than moisture retention. The writer's soil happens to be naturally " open " and *his* problem is moisture retention. Our soil, on the other hand, is the opposite and naturally " closes up " and *our* problem is therefore aeration. I've had to reply rather dogmatically that he's talking nonsense. It's so dangerous to generalize in mushroom growing. And to dogmatize, did you say?

Mar. 31. There are several discrepancies in Norman Cooper's article in the April Bulletin. 1. Picking off trays is *not* quicker than off shelves. We do both, we should know. 2. A house of 36′ × 18′ × 8′, he says, would allow for 1,600 sq. ft. of tray area, inferring that it represents a capital saving on houses required for a given area. But later he says that " ladders are necessary if the trays are stacked high but this is a fault in plant design and can't be counted against the system." Why can't it? (*a*) Ladders are worse with trays than with shelves owing to the restricted picking area (of trays) with each move of the ladder, and (*b*) if less than 1,600 sq. ft. is to go into a house to conform to good planning—assuming this is what he means—more houses are needed to give the required area and capital is not saved. 3. I contend there is no " small advantage in crop production cost on trays " unless this is worked out only on a sq. ft. basis, and such a basis can be properly misleading. 4. Many growers have gone over to trays because (they understood) they could mechanize. Now Norman tells us we needn't mechanize on a small scale. He's right there, but wrong to leave us with the inference that trays on a small scale and unmechanized are necessarily better than shelves.

Apl. 1. Now Capt. Lawrence on creosote! Why, Oh Why, does everyone use or want to use creosote? Because some sundriesman once recommended it? I don't know. But you can take your Rose Comb, your " bishops ", and your " Mont Blancs " (we've never aspired to such heights ourselves) and you can take your creosote too! We learned the lesson in 1940.

Apl. 2. What sport we are having. *Chess* with a preference for " bishop's move ", *mountaineering* up Mont Blancs. I wait to hear about *fishing* for eelworms, *cricket* when we're stumping or " stumped ", *steeplechasing* over trays, *sow-hunting* in search of truffle-detectors, *ski-ing* down the freezing slopes of our price graphs, not to mention the topical sport of *spring-cleaning* for " cobweb ".

Apl. 3. My desk has been ruthlessly " trashed " and as a result I am constantly looking for lost papers. This calamity necessitates the inclusion of a filing system in my waste paper basket.

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